OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **LAKE WINNISQUAM, MOHAWK ISLAND** the program coordinators recommend the following actions. *We would like to encourage the association to conduct more sampling events in the future. With a limited amount of data it is difficult to determine water quality trends. Since weather patterns and activity in the watershed can change throughout the summer it is a good idea to sample the lake several times over the course of the season.*

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *stable* in-lake chlorophyll-a trend, however this is based on one test per summer since 1995. The August chlorophyll concentration was the lowest measured since 1996, and remained well below the NH mean reference line. The dominant alga was *Chrysosphaerella,* a golden-brown alga. We recommend sampling once a month during the summer so we will be able to accurately establish a trend in chlorophyll concentrations. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are internal and external sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *slightly improving* trend in lake transparency. Water clarity has not been this high since 1994. The low concentration of algae helped to improve the Secchi disk reading. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *fairly stable* trend for epilimnetic phosphorus levels and a *variable* trend in the hypolimnion. The phosphorus concentration in the epilimnion was quite low, which helped keep algal growth to a minimum. The phosphorus concentration in the hypolimnion was back below the NH median from the high concentrations in 1997 and 1998. Phosphorus results for both layers were below the median for NH lakes this season. This lake station has only been sampled once per summer since 1995. We recommend more frequent sampling during the 2001 season to be able to accurately form trend analyses. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- **Please note** in August this summer the epilimnetic phosphorus level was recorded as less than 5 µg/L. The NHDES Laboratory Services adopted a new method of reporting total phosphorus this year and the lowest value that can be recorded is 'less than 5 µg/L'. We would like to remind the association that a reading of 5 µg/L is considered low for New Hampshire's waters.

- There was a slight increase in in-lake conductivity since the 1998 season (Table 6). This might be the result of excess nutrients being flushed from the watershed, or it could be the remnants of the dry season in 1999 and the lack of lake flushing. With continued monitoring, we hope to see the conductivity remain stable in the lake. Conductivity increases often indicate the influence of human activities on surface waters. Septic system leachate, agricultural runoff, iron deposits, and road runoff can all influence conductivity.

- We are pleased to report that the hypolimnetic phosphorus concentration has shown a significant decrease this season (Table 8)! This is the result of a decrease in the turbidity of the sample (Table 11). Previously, the samples had contained a significant amount of bottom sediment, which normally has phosphorus attached to it. The sediment contamination yielded high, inaccurate phosphorus results. The results of the 2000 season are representative of the actual phosphorus concentrations in the hypolimnion, and we hope to see these results continue into the 2001 sampling season.

- Dissolved oxygen was approaching the critical level of 1.0 mg/L in the last meter of the lake in August this season (Table 9). The process of decomposition in the sediments depletes dissolved oxygen on the bottom of thermally stratified lakes. As bacteria break down organic matter, they deplete oxygen in the water. When oxygen gets below 1 mg/L, phosphorus normally bound up in the sediments may be released into the water column, a process that is referred to as *internal loading*. Monitors may wish to schedule the annual lake visit in August again next season, so we can monitor the extent of oxygen depletion in the last meter of the lake.

USEFUL RESOURCES

A Guide to Developing and Re-Developing Shoreland Property in New Hampshire: A Blueprint to Help You Live By the Water. North Country RC&D, 1994. (603) 527-2093.

What Can You Do To Prevent Soil Erosion?, WD-BB-30, NHDES Fact Sheet. (603) 271-3503 or www.state.nh.us

In Our Backyard. 1994. Terrence Institute, 4 Herbert St., Alexandria, VA. 22305, or call (800) 726-5253, or www.terrene.org

Proper Lawn Care Can Protect Waters, WD-BB-31, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Phosphorus in Lakes, WD-BB-20, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Shoreland Plantings, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

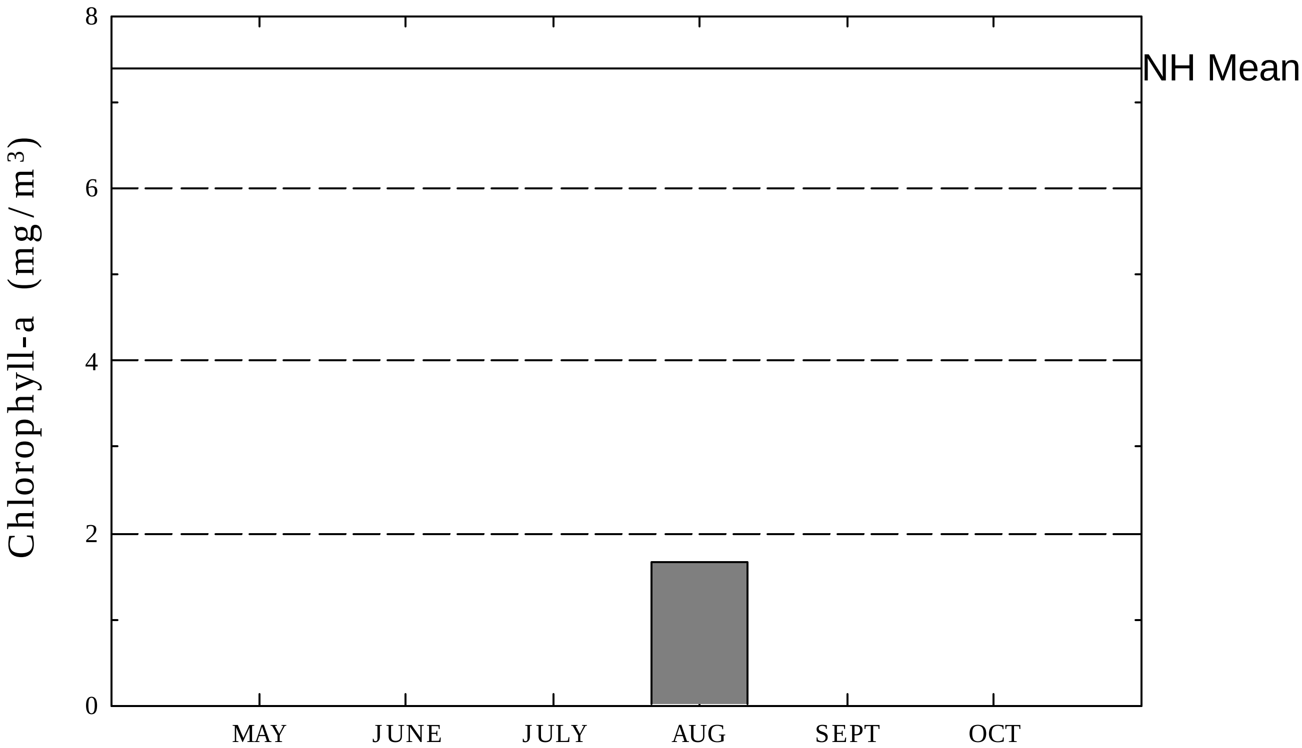
Handle With Care: Your Guide to Preventing Water Pollution. Terrene Institute, 1991. (800) 726-5253, or www.terrene.org

Road Salt and Water Quality, WD-WSQB-7, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

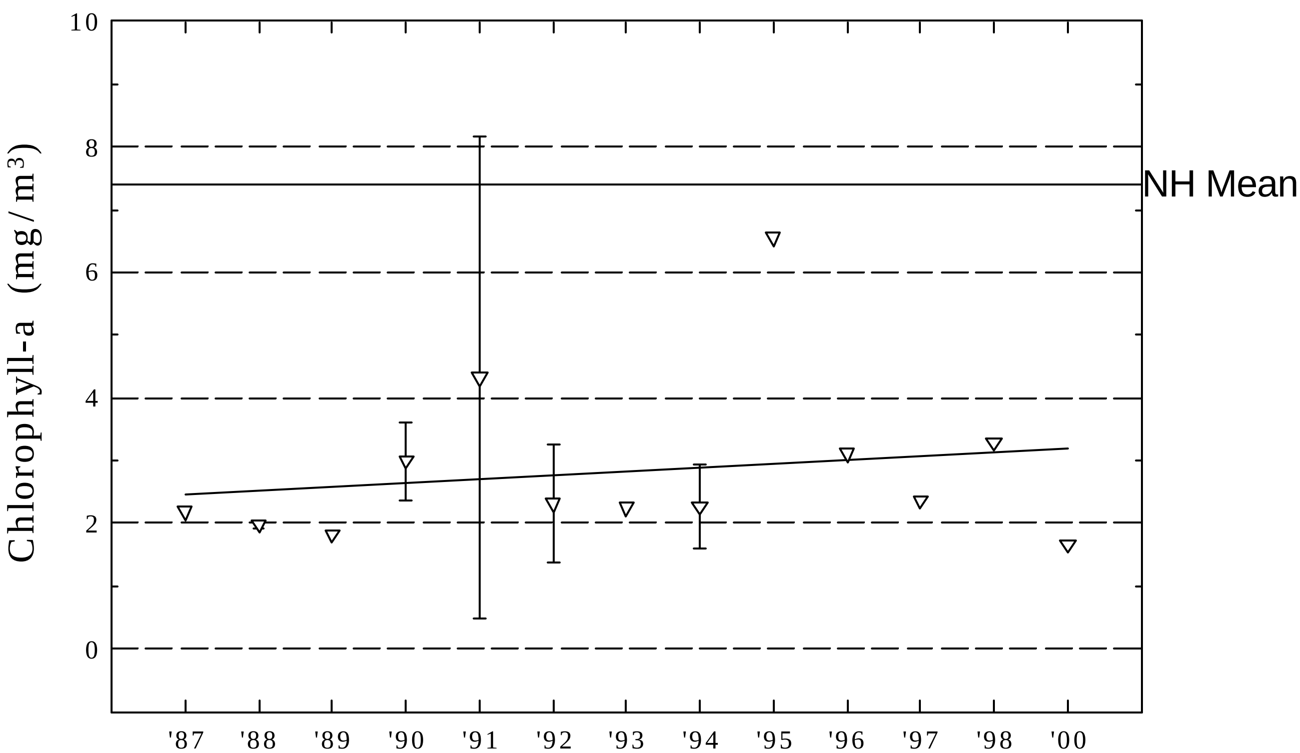
Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Lake Winnisquam, Mohawk Island

Figure 1. Monthly and Historical Chlorophyll-a Results



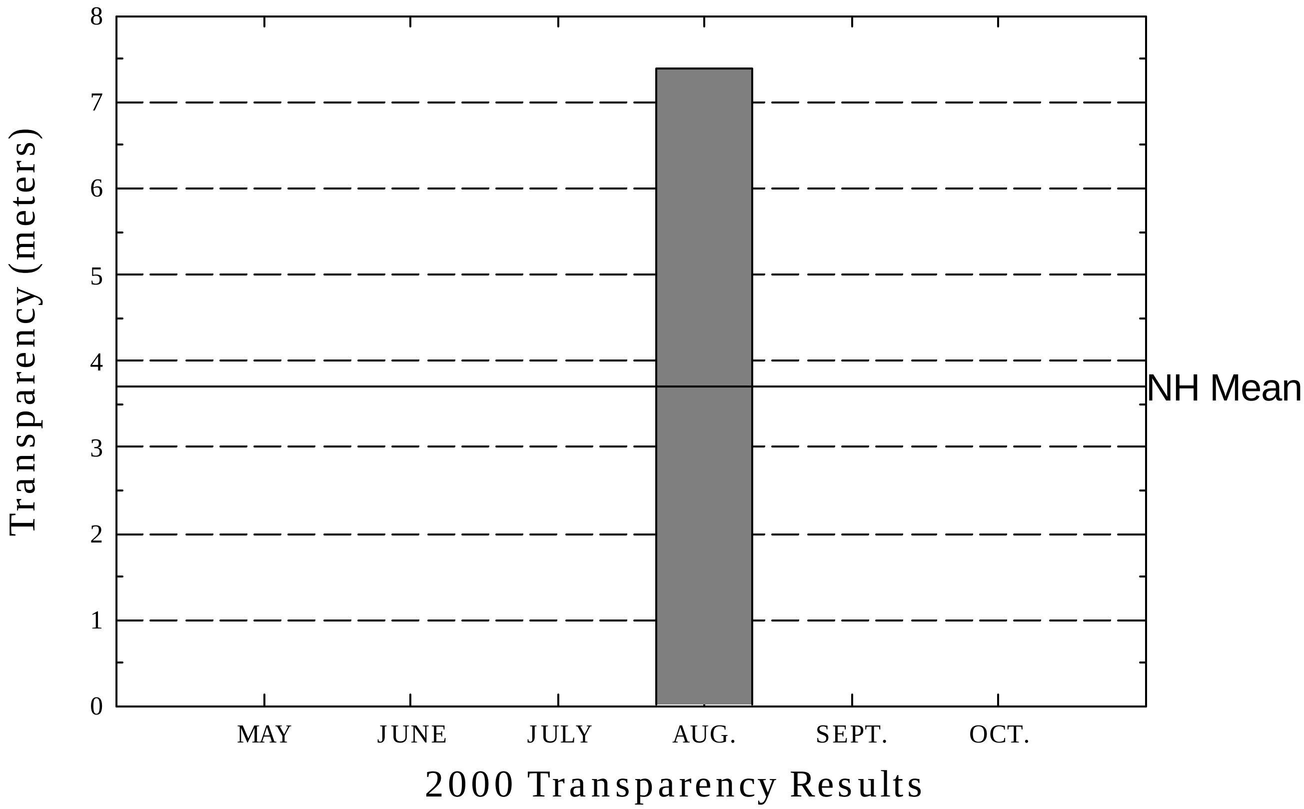
2000 Chlorophyll-a Results

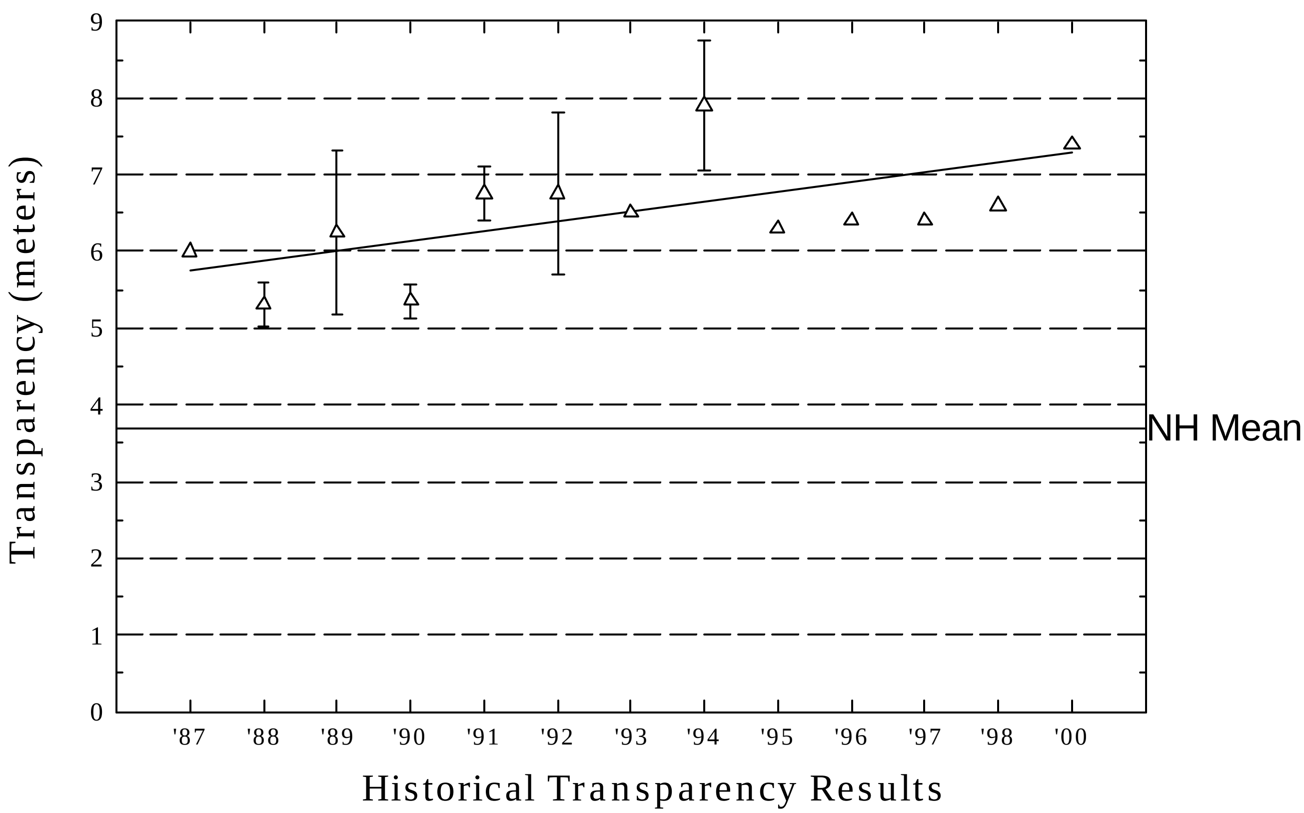


Historical Chlorophyll-a Results

Lake Winnisquam, Mohawk Island

Figure 2. Monthly and Historical Transparency Results





Lake Winnisquam, Mohawk Island

Figure 3. Monthly and Historical Total Phosphorus Data.

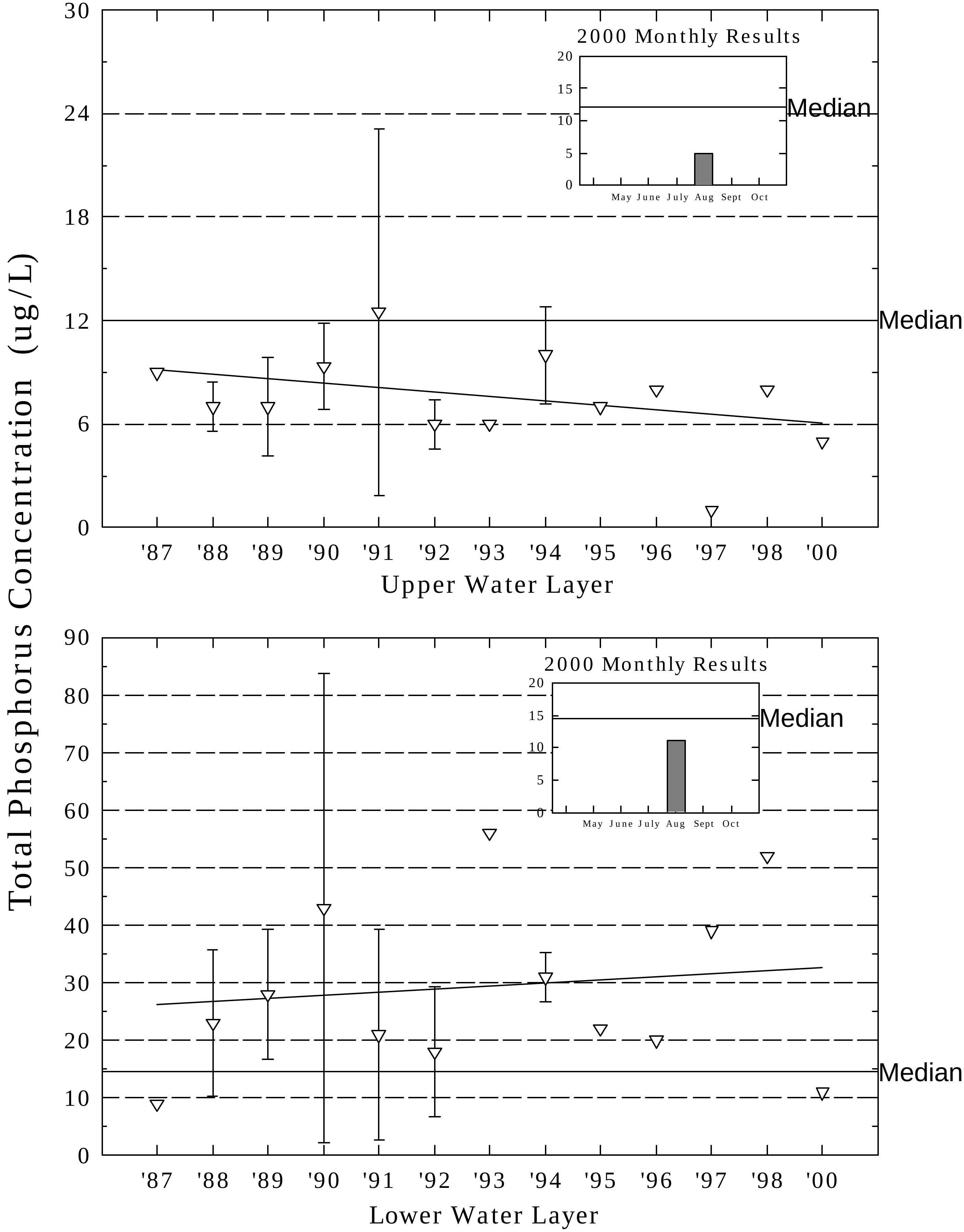


Table 1.

WINNISQUAM, MOHAWK ISL.
BELMONT

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1987	2.19	2.19	2.19
1988	1.95	2.04	1.99
1989	1.82	1.82	1.82
1990	2.56	3.44	3.00
1991	1.60	7.05	4.32
1992	1.64	2.99	2.31
1993	2.25	2.25	2.25
1994	1.80	2.75	2.27
1995	6.56	6.56	6.56
1996	3.11	3.11	3.11
1997	2.37	2.37	2.37
1998	3.30	3.30	3.30
2000	1.66	1.66	1.66

Table 2.

WINNISQUAM, MOHAWK ISL.

BELMONT

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
09 / 02 / 1987	CHRYSOSPHAERELLA	41
	ASTERIONELLA	20
	TABELLARIA	16
06 / 30 / 1988	DINOBRYON	50
	ASTERIONELLA	24
	TABELLARIA	18
07 / 14 / 1989	DINOBRYON	63
	ASTERIONELLA	
	TABELLARIA	
05 / 08 / 1990	ASTERIONELLA	53
	DINOBRYON	38
07 / 05 / 1990	DINOBRYON	48
	TABELLARIA	17
	CHRYSOSPHAERELLA	11
08 / 15 / 1991	CHRYSOSPHAERELLA	40
	SYNURA	13
	MELOSIRA	13
07 / 01 / 1992	ASTERIONELLA	42
	TABELLARIA	29
07 / 20 / 1994	DINOBRYON	50
	COELOSPHAERIUM	11
	ANABAENA	11
08 / 17 / 1994	CHRYSOSPHAERELLA	40
	DINOBRYON	23
	TABELLARIA	10
08 / 15 / 1995	CHRYSOSPHAERELLA	44
	DINOBRYON	22
	CERATIUM	12
08 / 16 / 1996	BLUEGREEN SPP	35
	DINOBRYON	20
	TABELLARIA	20

Table 2.

WINNISQUAM, MOHAWK ISL.

BELMONT

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
08 / 14 / 1997	CHRYSOSPHAERELLA	59
	DINOBRYON	14
	SYNURA	9
08 / 13 / 1998	APHANIZOMENON	23
	ASTERIONELLA	13
	DINOBRYON	12
08 / 18 / 2000	CHRYSOSPHAERELLA	71
	DINOBRYON	10
	CERATIUM	6

Table 3.

WINNISQUAM, MOHAWK ISL.

BELMONT

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1987	6.0	6.0	6.0
1988	5.1	5.5	5.3
1989	5.5	7.0	6.2
1990	5.2	5.5	5.3
1991	6.5	7.0	6.7
1992	6.0	7.5	6.7
1993	6.5	6.5	6.5
1994	7.3	8.5	7.9
1995	6.3	6.3	6.3
1996	6.4	6.4	6.4
1997	6.4	6.4	6.4
1998	6.6	6.6	6.6
2000	7.4	7.4	7.4

Table 4.

WINNISQUAM, MOHAWK ISL.
BELMONT

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1987	7.06	7.06	7.06
	1988	6.86	7.01	6.93
	1989	6.88	7.09	6.97
	1990	6.93	7.28	7.02
	1991	7.10	7.12	7.11
	1992	6.82	7.15	6.95
	1993	7.13	7.13	7.13
	1994	6.92	7.01	6.96
	1995	6.77	6.77	6.77
	1996	6.83	6.83	6.83
	1997	7.04	7.04	7.04
	1998	6.94	6.94	6.94
	2000	6.96	6.96	6.96
HYPOLIMNION				
	1987	6.94	6.94	6.94
	1988	6.19	6.49	6.31
	1989	6.31	6.79	6.49
	1990	6.41	6.83	6.59
	1991	6.40	6.60	6.49
	1992	6.58	6.85	6.69
	1993	6.63	6.63	6.63
	1994	6.20	6.29	6.24
	1995	5.94	5.94	5.94
	1996	6.24	6.24	6.24
	1997	6.44	6.44	6.44
	1998	6.25	6.25	6.25

Table 4.

WINNISQUAM, MOHAWK ISL.
BELMONT

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	2000	6.32	6.32	6.32
JAY'S MARINA INLET				
	1987	6.48	6.48	6.48
	1989	6.45	6.78	6.58
METALIMNION				
	1988	6.42	6.85	6.58
	1989	6.36	6.86	6.54
	1990	6.88	7.22	7.02
	1991	7.00	7.20	7.09
	1992	6.86	7.19	6.99
	1993	6.79	6.79	6.79
	1994	6.86	6.88	6.87
	1995	6.50	6.50	6.50
	1996	6.49	6.49	6.49
	1997	6.73	6.73	6.73
MOHAWK INLET				
	1989	6.57	6.57	6.57
OUTLET				
	1987	6.98	6.98	6.98

Table 5.

WINNISQUAM, MOHAWK ISL.

BELMONT

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1987	6.80	6.80	6.80
1988	7.00	7.20	7.10
1989	6.40	6.90	6.65
1990	6.80	7.80	7.20
1991	6.30	6.80	6.55
1992	6.50	8.40	7.45
1993	6.30	6.30	6.30
1994	5.50	7.20	6.35
1995	7.70	7.70	7.70
1996	6.70	6.70	6.70
1997	6.20	6.20	6.20
1998	7.00	7.00	7.00
2000	7.50	7.50	7.50

Table 6.

WINNISQUAM, MOHAWK ISL.
BELMONT

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1987	65.7	65.7	65.7
	1988	68.9	69.3	69.1
	1989	67.4	67.9	67.6
	1990	72.2	75.1	73.3
	1991	70.5	73.5	72.0
	1992	75.5	77.3	76.4
	1993	75.3	75.3	75.3
	1994	77.2	78.4	77.8
	1995	79.4	79.4	79.4
	1996	72.7	72.7	72.7
	1997	72.0	72.0	72.0
	1998	68.7	68.7	68.7
	2000	80.5	80.5	80.5
HYPOLIMNION				
	1987	65.3	65.3	65.3
	1988	70.1	71.9	71.0
	1989	74.5	76.6	75.5
	1990	75.4	79.5	77.1
	1991	70.2	76.0	73.1
	1992	74.9	77.3	76.1
	1993	78.9	78.9	78.9
	1994	79.5	81.4	80.4
	1995	78.6	78.6	78.6
	1996	79.3	79.3	79.3
	1997	76.1	76.1	76.1

Table 6.

WINNISQUAM, MOHAWK ISL.
BELMONT

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1998	81.0	81.0	81.0
	2000	83.6	83.6	83.6
JAY'S MARINA INLET				
	1987	62.6	62.6	62.6
	1989	67.1	73.1	70.1
METALIMNION				
	1988	70.3	70.3	70.3
	1989	67.8	68.6	68.2
	1990	71.3	74.4	72.7
	1991	69.9	70.1	70.0
	1992	74.7	75.9	75.3
	1993	78.6	78.6	78.6
	1994	77.8	78.3	78.0
	1995	77.2	77.2	77.2
	1996	75.1	75.1	75.1
	1997	71.9	71.9	71.9
MOHAWK INLET				
	1989	105.4	105.4	105.4
OUTLET				
	1987	65.2	65.2	65.2

Table 8.

WINNISQUAM, MOHAWK ISL.
BELMONT

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1987	9	9	9
	1988	6	8	7
	1989	5	9	7
	1990	7	12	9
	1991	5	20	12
	1992	5	7	6
	1993	6	6	6
	1994	8	12	10
	1995	7	7	7
	1996	8	8	8
	1997	1	1	1
	1998	8	8	8
	2000	< 5	5	5
HYPOLIMNION				
	1987	9	9	9
	1988	14	32	23
	1989	20	36	28
	1990	19	90	43
	1991	8	34	21
	1992	10	26	18
	1993	56	56	56
	1994	28	34	31
	1995	22	22	22
	1996	20	20	20
	1997	39	39	39

Table 8.

WINNISQUAM, MOHAWK ISL.
BELMONT

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1998	52	52	52
	2000	11	11	11
JAY'S MARINA INLET				
	1987	19	19	19
	1989	13	20	16
METALIMNION				
	1988	< 1	10	5
	1989	7	12	9
	1990	10	16	12
	1991	5	13	9
	1992	6	10	8
	1993	9	9	9
	1994	10	12	11
	1995	11	11	11
	1996	10	10	10
	1997	3	3	3
MOHAWK INLET				
	1989	33	33	33
OUTLET				
	1987	< 1	1	1

Table 9.

WINNISQUAM, MOHAWK ISL.
BELMONT

Current year dissolved oxygen and temperature data.

Depth (meters)	**Temperature** (celsius)	**Dissolved Oxygen** (mg/L)	**Saturation** (%)
	August 18, 2000		
0.1	22.1	7.9	90.8
1.0	21.9	7.9	90.6
2.0	21.6	7.9	90.2
3.0	21.6	7.9	89.6
4.0	21.5	8.0	90.2
5.0	21.5	7.9	89.3
6.0	21.3	7.7	86.8
7.0	19.9	6.8	74.3
8.0	15.9	4.9	49.5
9.0	13.5	2.3	22.4
10.0	12.2	1.1	10.2

Table 10.

WINNISQUAM, MOHAWK ISL.

BELMONT

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
September 2, 1987	9.0	17.0	0.2	2.0
June 30, 1988	13.0	8.0	7.4	62.0
July 14, 1989	13.0	10.2	2.3	20.0
July 5, 1990	15.0	9.5	1.7	14.8
August 15, 1991	13.0	9.0	0.3	2.6
July 1, 1992	12.0	8.5	7.2	61.3
July 20, 1994	15.0	9.0	2.6	22.0
August 15, 1995	11.0	12.6	1.0	9.0
August 16, 1996	10.0	13.5	0.4	4.0
August 18, 2000	10.0	12.2	1.1	10.2

Table 10.

WINNISQUAM, MOHAWK ISL.

LACONIA

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	**Depth** (meters)	**Temperature** (celsius)	**Dissolved Oxygen** (mg/L)	**Saturation** (%)
August 13, 1998	13.0	13.5	0.1	1.0

Table 11.

WINNISQUAM, MOHAWK ISL.

BELMONT

Summary of current year and historic turbidity sampling.

Results in NTU's.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1997	0.2	0.2	0.2
	1998	0.3	0.3	0.3
	2000	0.2	0.2	0.2
HYPOLIMNION				
	1997	4.4	4.4	4.4
	1998	4.2	4.2	4.2
	2000	0.7	0.7	0.7
METALIMNION				
	1997	0.2	0.2	0.2